

Remarks

Claims 1-12 were pending in the application. Claims 1-5 and 7-11 are amended. Claims 1-12 remain pending. Please reconsider and reexamine the application in light of the amendments and remarks which follow.

Objections were made to the language “the sensor” in claims 2-5 and 9-11. Applicant has changed such language in the respective claims to refer to “sensors” (plural). The basis is implicit for the claims as originally written.

Claim 7 was rejected under section 112 as being indefinite. The language “such as” considered as indefinite has been replaced with the transitional phrase “comprising”.

Claims 1, 4, 7 and 8 were rejected under section 102 over Harrison. Several of the claims were also rejected under section 103 over Harrison, or over Harrison combined with Van Steenwyk.

In response to such rejections, the Applicant draws attention to the present specification at page 1, lines 6-24, and at page 16, lines 16-19. In the former of these sections reference is made to the prior art arrangements having three mutually perpendicular accelerometers to determine the inclination of the drill string, and three mutually perpendicular magnetic fluxgates to determine the magnetic orientation (or azimuth) of the drill string. The description recites that the prior art cannot provide the inclination and azimuth information for a drill string with only two sensors, specifically a single accelerometer and a single magnetic fluxgate or rate gyro (the fluxgate and rate gyro being alternatives).

The Harrison reference (US patent application 2002/0112887), does not disclose the use of any less than three accelerometers and three fluxgate magnetometers. In

particular, the specific description at paragraph “[0021]” of Harrison discloses the use of a “triad of accelerometers 18” and a “triad of flux-gate magnetometers 20” (the term “triad” referring to three sensors arranged with mutually perpendicular sensing axes). Moreover, Figs. 1-2 reference “accelerometers” and “magnetometers” in the plural and not in the singular.

Van Steenwyk (US Patent 4,706,388), cited under the section 103 rejections also relies upon at least three sensors, some of which sensors are multi-axis sensors.

The Harrison and Van Steenwyk references are therefore like the prior art cited at page 1 of the present application as discussed above.

The distinction over the prior art is believed to be a point of novelty per 37 CFR 1.111(c) (and it is believed the cited art does not teach or suggest same). The Applicant has clarified the distinction by including the term “solely” after the word “deriving” in the independent claims (Claim 1, and similarly in Claim 8). The basis for these changes is implicit from the specification at page 1, lines 18-22. Distinction from the cited art also lies in that the first and second sensors are both defined in the independent claims as being single-axis sensors.

As a result of the inclusion of the word “solely” in relation to measurement of the azimuth angle in both of Claims 1 and 8, such claims have been further changed to clarify that both sensors are required to determine the azimuth angle. In particular, it is necessary to know the angle of inclination (derived from the first sensor alone) before the azimuth angle can be determined. Accordingly, in the formula set out at page 12, lines 20-21 (and subsequent formulae) and the formula set out at page 14, lines 6-7 (and subsequent formulae), the inclination angle “INC” (which is defined at page 10, line 11)

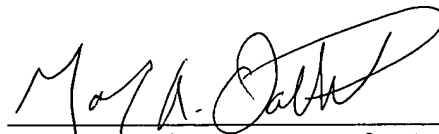
is a necessary part of the formula used to determine the azimuth angle and it is stated at page 15, lines 18-19 that the gyro azimuth angle "GAZ" can be determined provided that certain values are known, one of the values being the inclination angle "INC".

Finally, Claims 5 and 11 have been amended to clarify that the integration is performed over "each of" the four quadrants of rotation. The basis for these changes appears at page 2, lines 28-29 and page 3, lines 21-24 of the specification.

The dependent claims are believed to be allowable as being dependent upon the independent claims.

Please reconsider and reexamine the application in light of the amendments and the remarks; and telephone the undersigned attorney if it could help to expedite the resolution of this application.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read "Mark A. Oathout", written over a horizontal line.

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